AIR FORCE

QUALIFICATION TRAINING PACKAGE (AFQTP)

for

ELECTRICAL POWER PRODUCTION

(3E0X2)

MODULE 16

GASOLINE AND DIESEL ENGINE MAINTENANCE

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MODULE 16

GASOLINE AND DIESEL ENGINE MAINTENANCE

Career Field Education and Training Plan (CFETP) references from 1 Apr 97 version.

OPR: HQ AFCESA/CEOT
(SMSgt Glenn L. Deese)

Certified by: HQ AFCESA/CEO
(Colonel Lance C. Brendel)

AIR FORCE QUALIFICATION TRAINING PACKAGES
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ELECTRICAL POWER PRODUCTION
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INTRODUCTION

Before starting this AFQTP, refer to and read the "Trainee/Trainer Guide" located on the AFCESA Web site **http://www.afcesa.af.mil/**

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

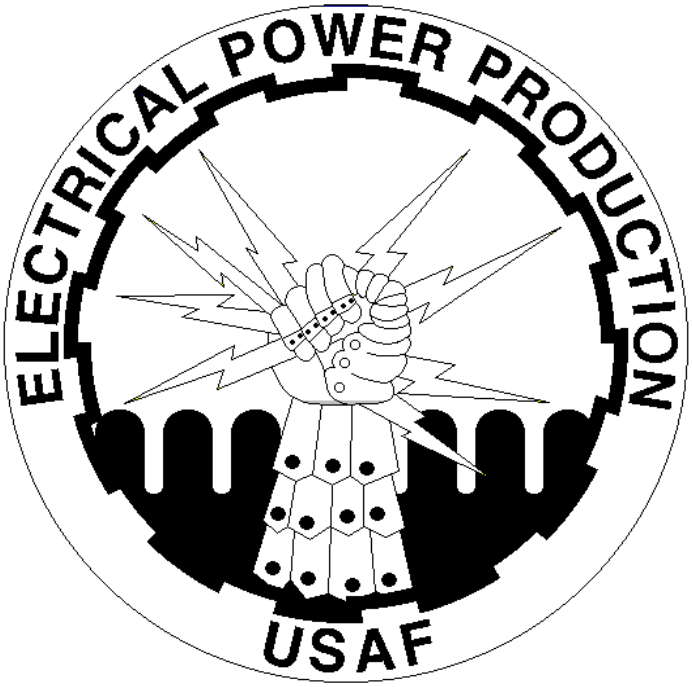
Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOT revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

HQ AFCESA/CEOT
139 Barnes Dr. Suite 1
Tyndall AFB, FL 32403-5319
DSN: 523-6392, Comm: (850) 283-6392
Fax: DSN 523-6488
E-mail: ceott.helpdesk@tyndall.af.mil

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



GASOLINE AND DIESEL ENGINE MAINTENANCE

MODULE 16 **AFQTP UNIT 11**

TUNE-UP GASOLINE ENGINE SYSTEMS (16.11.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

TUNE-UP GASOLINE ENGINE SYSTEMS

Task Training Guide

STS Reference Number/Title:	16.11., Tune-Up Gasoline Engine Systems
Training References:	• 35E8 and 38G2 Series Technical Orders • Manufacturer's Manuals • Local Procedures
Prerequisites:	• Possess, as a minimum, 3E032 AFSC
Equipment/Tools Required:	• Gasoline engine • Personal safety equipment • Training references • Low pressure gauge • Neon timing light
Learning Objective:	• Tune-up gasoline engine systems.
Samples of Behavior:	• Trainee will tune-up gasoline engine systems.
Notes:	
• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. • Any safety violation is an automatic failure.	

TUNE-UP GASOLINE ENGINE SYSTEMS

Background: The gasoline engine selected for the development of this AFQTP is the V-465D Wisconsin engine (covered in T.O. 38G2-117-3 and shown in Figure 1). This Engine is used as the rewind source for the BAK-12 and MAAS aircraft arresting systems. This engine is a four-cylinder, four-cycle, air-cooled engine. The V-465D systems we will tune-up or discuss are the carburetor, ignition, lubrication, cooling, and governor. We will provide a brief overview of these systems before beginning our tune-up.

The V-465D Wisconsin engine uses a horizontal carburetor with a concentric fuel bowl. Proper gasoline to air mixture is furnished to the combustion chamber for all loads and speeds. It is a balanced carburetor since all air , fuel chamber, metering well ventilation, and idling must come through the air cleaner.

The ignition system consists of a magneto ignition system, 12-volt DC battery, a starter motor, high temperature safety switch, spark plugs, anti-diesel solenoid, ignition start switch, and start solenoid. The cylinder firing order is 1-3-4-2 with cylinder number 1 being the one closest to the flywheel in the left bank (odd numbered bank) when viewed from the flywheel end.

A centrifugal fly-ball governor controls the engine speed by varying the throttle opening to suit the load imposed on the engine. The governor rotates on a stationary pin pressed into the upper part of the timing gear cover. The governor is driven off the camshaft gear and turns 1/8 faster than the crankshaft speed.

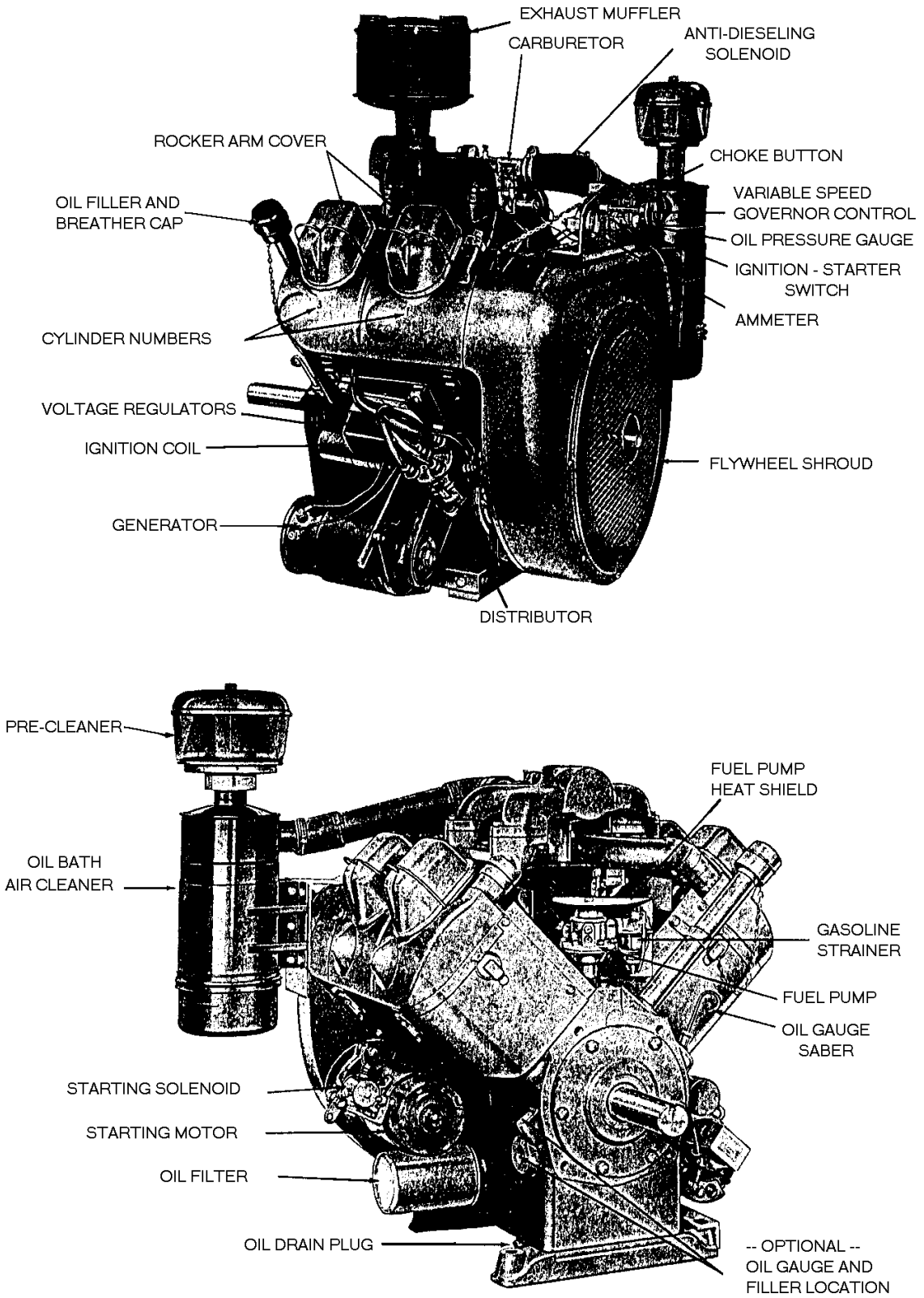


FIGURE 1, V-465D WISCONSIN GASOLINE ENGINE.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

To Perform the task, follow these steps:

Step 1: Start-up engine.

- Perform a pre-operational check. Crankcase oil level, fuel level and battery condition.
- Pull the over center clutch handle clockwise to disengage the clutch.
- Pull the manual throttle control out about one inch.
- Turn ignition-starting switch to the start position and at the same time pull out the choke control handle to the full out position.
- Release the choke control handle to the open position after the engine starts.
- If flooding should occur, continue cranking with the starting motor, but with choke open (choke handle in).
- After the engine starts, push in choke control as required for smooth running. Clutch must be completely in when the engine is warmed up.
- After warm-up, place the manual throttle control in a position which operates the engine at 1,000 +/- 100 rpm on engine tachometer

Step 2: Stop engine.

- Remove load from the engine and reduce speed to approximately 1000-1200 RPM.
- Allow engine to operate for three the five minutes, for cool down.
- Turn ignition-starting switch to the off position, push throttle in.
- Perform a post-operational check.

Step 3: Adjust engine carburetor.

The main metering jet in the carburetor is of the fixed type, that is, it requires no adjustment. The idle needle should be adjusted for best low speed operation, while the carburetor throttle is closed by hand.

- Adjust the throttle stop screw to obtain the desired idling speed. The idle adjusting needle should be in proper adjustment at about ¾ to 1 turn open.
- Adjust the idle adjusting needle to obtain smooth idling of the engine (turn the needle out, counter-clockwise, to make the mixture richer; turn the needle in, clockwise, to make the mixture leaner).

Step 4: Time magneto to the engine.

The magneto requires no maintenance unless all the above items have been test and the problem persists, or if during maintenance it was removed. If it was removed for service the operator must follow the engine manufacturer's instructions for timing the magneto to the engine.

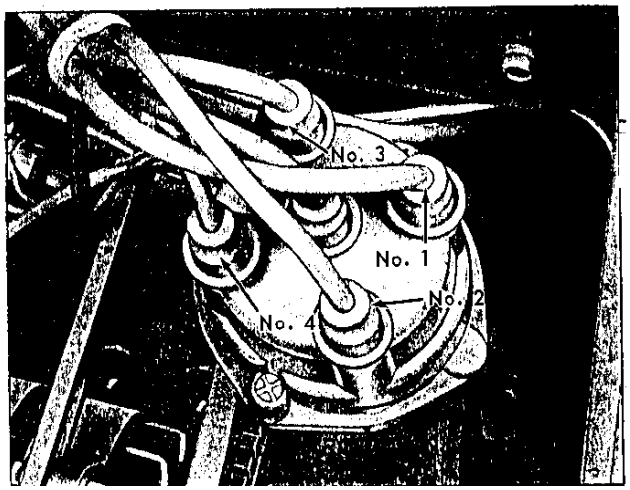


Figure 3, Distributor Cap and Cylinder Tower Numbers.

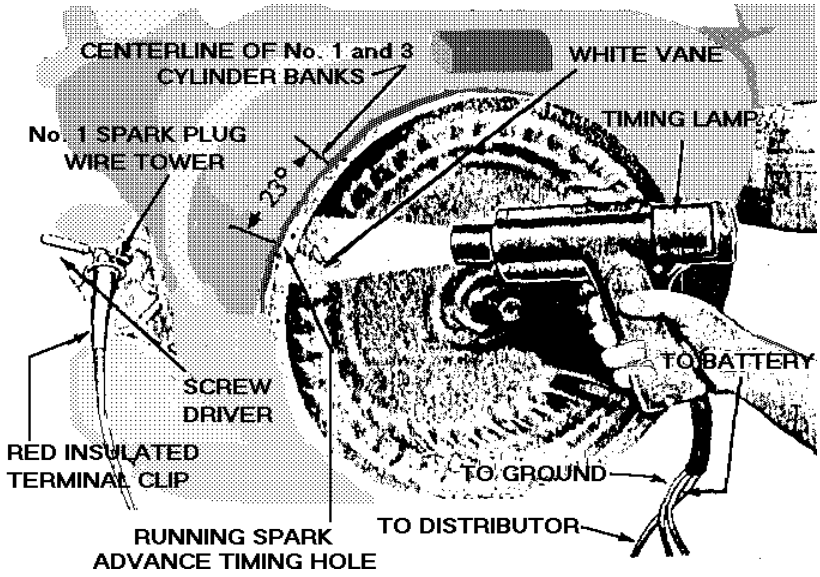


FIGURE 3, TIMING ENGINE WITH A NEON LIGHT

Step 5: Check the timing with a neon timing light (Figure 3).

The engine should be timed to the 23-degree advance position at not less than 2000 RPM.

- Insert a small screwdriver into the number 1 terminal tower on the distributor cap, making contact with the sparkplug wire terminal.
- Connect the red terminal clip, of the timing light, to the metal portion of the screwdriver.
- Connect one of the other timing light leads to the battery, and the other to ground.
- With white chalk or paint highlight the end of the "X"-marked vane on the flywheel.
- Operate the engine at 2000 RPM or higher and allow the flash from the neon lamp to illuminate the whitened vane.
- At the time of flash, the leading edge of the vane should line up with the running advance timing hole on the flywheel shroud. (See figure 3).

- If the leading edge of the vane shroud and the running advance timing hole do not line up, loosen the distributor clamp screw and rotate the body slightly clockwise or counterclockwise until the white flywheel vane matches up with the advance timing hole. Carefully tighten the distributor clamp screw.
- Shut down the engine and secure all shrouding, covers, plug wires and equipment.

HINT: The running spark advance is 23-degrees before the centerline of the number 1 and 3 cylinders.
HINT: The magneto breaker point gap is 0.015-inch at full separation. If the ignition spark is weak after continued operation, the breaker points may have to be readjusted or replaced.

Step 6: Gap spark plugs.

- Remove old spark plugs, if serviceable you may clean, re-gap, and reuse.
- Using wire gauge, check plug gap and set to 0.030-inch.
- Install new gasket on spark plug.
- Clean threads in cylinder head.
- Install spark plug in cylinder and torque to 22 foot-pounds repeat as required.

Step 7: Service air intake system.

- The oil bath cleaner must be serviced frequently, depending on the dust conditions. Service daily if required or operated under very dusty conditions.
- Remove the oil cup from the bottom of air cleaner and clean thoroughly with clean diesel fuel
- Add the same grade of oil as used in crankcase to the level line indicated on the oil cup.
- Reinstall the oil cup.
- Remove and clean the air cleaner element once every year as a minimum. Soak and clean the element with an approved solvent.

Step 8: Service gasoline supply system.

- The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems. The strainer has a glass bowl and should be inspected frequently, and cleaned if dirt or water are present.
- To clean, loosen the nut below the bowl and swing the wire bail to one side to remove the bowl.
- Next clean the bowl and screen and reinstall the bowl replacing the gasket.

Step 9: Perform post-operational checks.

- Clean exterior of engine using engine degreaser, brushes, rags, and low pressure air as needed.
- Ensure documentation oof maintenance is complete.

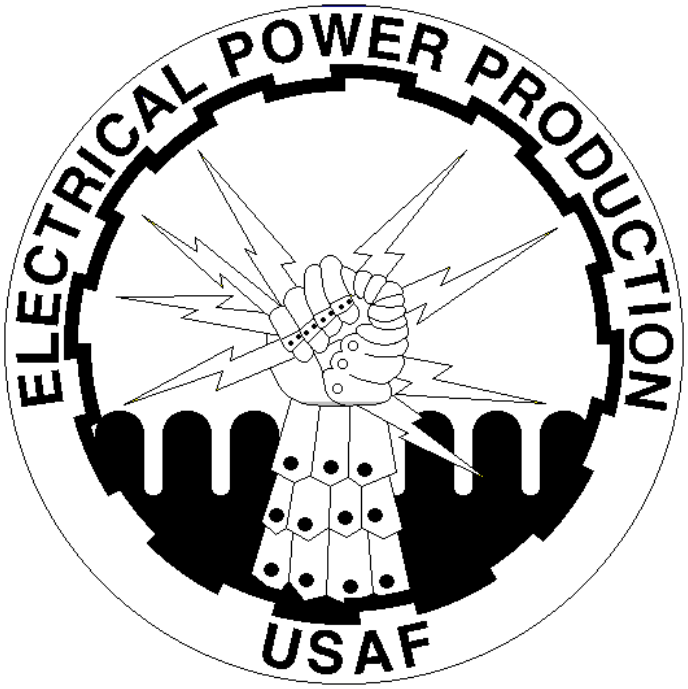
Review Questions
for
Tune-Up Gasoline Engine Systems

Question	Answer
1. The carburetor provides the proper gasoline to air mixture for the combustion chamber for all loads and speeds.	a. True b. False
2. What determines if a carburetor is balanced?	a. Proper fuel and air mixture. b. All air for fuel chamber, metering well ventilation, and idling must come through the air cleaner c. The carburetor and fuel injection pump are a balanced and matched set d. All of the above
3. The air is divided and directed by ducts and baffle plates to insure what type of cooling?	a. Evaporative cooling caused by condensing vapors b. Uniform cooling of all parts c. Refrigerated d. None of the above
4. Why should an air cooled engine never operate with any part of the shrouding removed?	a. Will have no effect on engine operation b. Cause low engine operating temperature c. Retard the air cooling capabilities of the engine d. All of the above
5. How can you verify that the number 1 cylinder is on the compression stroke?	a. Remove rocker arm cover from number 1 cylinder and rotate engine with hand crank until inlet valve opens and closes b. Observe that the leading edge of the "X" marked flywheel vane is in line with the vertical centerline mark of the No. 1 and 3 cylinder bank. c. The flywheel keyway is on top a. All of the above
6. What is the minimum rpm that the engine must operate when checking the timing with a neon light?	a. 1000 b. 1200 c. 1800 d. 2000
7. Under what conditions should the oil bath air cleaner be serviced daily?	a. Normal b. Dry c. Wet a. Dusty
8. The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems.	a. True d. False

TUNE-UP GASOLINE ENGINE SYSTEMS

Performance Checklist		
Step	**Yes**	**No**
Did trainee perform the following:		
1. Started the engine		
2. Stopped the engine		
3. Adjusted engine carburetor		
4. Checked the timing with a neon timing light		
5. Re-gapped spark plugs		
6. Serviced air intake system		
7. Serviced gasoline supply system		
8. Cleaned exterior of engine		
9. Document maintenance		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



ENGINE PROTECTIVE DEVICES

MODULE 16 **AFQTP UNIT 12**

INSPECT (16.12.1.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

INSPECT

Task Training Guide

STS Reference Number/Title:	16.12.1., Inspect
Training References:	• 35C2 series Technical Orders • Local Procedures
Prerequisites:	• Possess, as a minimum, 3E032 AFSC
Equipment/Tools Required:	• General tool box • Required safety equipment
Learning Objective:	• Clean and inspect engine protective transmitters and switches.
Samples of Behavior:	• The trainee will know what a transmitter does. • The trainee will know when a switch will shut down a generator.
Notes:	
• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. • Any safety violation is an automatic failure.	

INSPECT

Background: Technical Order 35C2-3-446-1 for the MEP-005A was used during the development of this AFQTP. Many of the protective indicators located on MEP generators are in the A9 fault indicator panel. These include:

- **Low oil pressure indicator**- indicates insufficient lubricating oil pressure. The engine lube oil pressure is read through a pressure transmitter. The engine is shut down by an oil pressure switch in the event that oil pressure falls below 20 psi.
- **Coolant high temperature indicator** - indicates excessively high coolant temperature. The coolant temperature is read though a temperature transmitter. The engine is shut down by an over temperature switch in the event that coolant temperature exceeds 220 degrees F.
- **Over-speed fault indicator** - indicates engine speed was excessive. A manually reset speed switch driven by the camshaft provides sequence control of circuits during starting and also provides automatic shutdown in the event of engine over-speed. The over-speed switch will trip at 120 to 122.5 percent continuous engine speed or 2400 to 2450 rpms.
- **No fuel indicator** - indicates that there is only enough fuel in the day tank for one minute. The day tank is equipped with a day tank fuel level and a low fuel cutoff switch which controls the fuel solenoid valve and provides automatic generator shutdown.

To Perform the task, follow these steps:

Step 1: Inspect transmitters.

Transmitters read a particular signal and send that signal to respective metering devices. There are two transmitters that are engine protective devices: The coolant temperature transmitter which is located on the engine thermostat housing and the oil pressure transmitter which is located on the engine block. The two transmitters are cleaned and inspected in the same way. Clean the transmitters and wiring harnesses with dry, filtered compressed air and a soft bristle brush or wipe with a clean lint free cloth lightly moistened with a fast drying, nonconductive electrical solvent. Inspect transmitters for cracked casing, stripped or damaged threads, corrosion, or other visible damage. Inspect the wiring harness for burned insulation, bent, corroded or otherwise damaged connectors and terminals.

SAFETY:
COMPRESSED AIR USED FOR CLEANING OR DRYING CAN CREATE AIRBORNE PARTICLES THAT MAY ENTER THE EYES. PRESSURE SHALL NOT EXCEED 30 PSI. WEARING OF GOGGLES IS REQUIRED.

Step 2: Inspect switches.

There are four different switches that are engine protective devices:

(1) The over temperature switch
(2) Low oil pressure switch
(3) Low fuel cutoff switch
(4) The over-speed switch

All of these switches are cleaned and inspected in the same way. Clean switches and wiring harnesses with dry, filtered compressed air and an electrician's brush or wipe with a clean, lint free cloth lightly moistened with a fast drying, nonconductive electrical solvent. Inspect switches for cracked casing, corrosion, stripped or damaged threads and bent or broken connector pins. For the low fuel cutoff switch ensure that the float is not damaged. Inspect wiring harness for burned insulation, bent, corroded or otherwise damaged connectors and terminals.

Step 3: Inspect fuel solenoid valve .

Clean the solenoid valve with dry, filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with a fast drying nonconductive electrical solvent. Inspect both devices for cracks, corrosion, stripped or damaged threads, and evidence of shorting or other defects. In addition inspect solenoid valve for bent or broken connector pins.

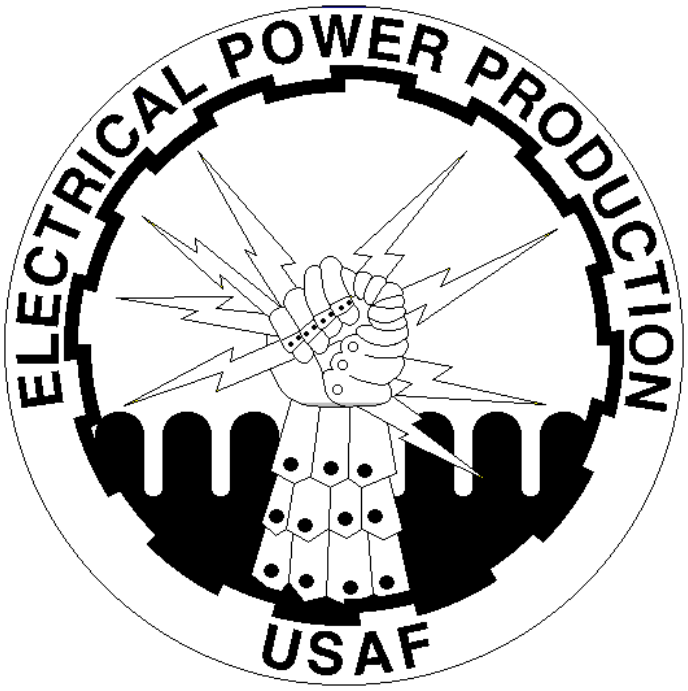
Review Questions
for
Inspect

Question	Answer
1. What PSI must not be exceeded when using compressed air to clean protective devices?	a. 10 b. 20 c. 30 d. 40
2. Where are the coolant temperature and the oil pressure transmitters located?	a. Radiator and the oil lines b. Tactical box and the oil pan c. Camshaft and the crankshaft d. Engine thermostat housing and the engine block
3. At what PSI will the generator shut down for low oil pressure?	a. 10 b. 20 c. 30 d. 40
4. What are the four protective switches covered in this QTP?	a. Over temperature, over-speed, low oil pressure, low fuel cutoff b. Under temperature, over-speed, low oil pressure, low fuel cutoff c. Over temperature, over-speed, high oil pressure, low fuel cutoff d. Over voltage, reverse power, short circuit, battle short

INSPECT

Performance Checklist		
Step	**Yes**	**No**
Did trainee properly perform the following:		
1. Inspected engine protective transmitters		
2. Inspected engine protective switches		
3. Inspected fuel solenoid valve and its rectifier assembly		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



ENGINE PROTECTIVE DEVICES

MODULE 16 **AFQTP UNIT 12**

TEST (16.12.2.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

TEST

Task Training Guide

STS Reference Number/Title:	16.12.2., Test
Training References:	• 35C2 series Technical Orders
Prerequisites:	• Possess, as a minimum, 3E032 AFSC
Equipment/Tools Required:	• General tool box • Multimeter • Personal safety equipment
Learning Objective:	• Test engine protective devices.
Samples of Behavior:	• The trainee will test the transmitters. • The trainee will test the different switches. • The trainee will test the fuel solenoid valve and the rectifier assembly.
Notes:	
• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. • Any safety violation is an automatic failure.	

TEST

Background: TO 35C2-3-446-1 technical order for the MEP-005A was used during the development of this AFQTP. You **must** use the applicable technical manual while you perform the protective device test procedures outlined below.

Step 1: Test transmitters.

The coolant temperature transmitter and the oil pressure transmitter are tested the same way.

- Test transmitters by disconnecting wiring harness connector from the transmitter.
- Connect ohmmeter between the connector and casing.
- Start and allow engine to operate while observing the ohmmeter.
- Resistance should increase to a reading of 680 to 740 ohms for the coolant temperature transmitter when the engine reaches normal operating temperature. The resistance should read 15 ohms at 30 psi and 30 ohms at 60 psi for oil pressure transmitter when the engine reaches normal operating temperature and oil pressure.
- Replace transmitter if resistance is not within specified limits.
- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

Step 2: Test over-temperature switch.

- Drain coolant from radiator and remove wiring from over-temperature switch.
- Unscrew over-temperature switch from its well.
- Test the over-temperature switch by suspending it in a container of clean oil so that sensing element is completely immersed but not touching the sides or bottom of the container.
- Suspend a reliable thermometer in the container. Do not allow the end of the thermometer to rest on the bottom of the container.
- Using an ohmmeter, check continuity between pins A and D and between pins B and C of the switch connector. A and D should indicate continuity (low resistance) and B and C should indicate discontinuity (an open). Attach ohmmeter leads to pins A and D.
- Gradually heat the oil, stirring so that heat will be evenly distributed, and observe the thermometer and ohmmeter.
- At 220 degrees +/- 3 degrees the ohmmeter should indicate discontinuity between pins A and D.
- Replace over-temperature switch if it fails to operate within the above limits.
- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

SAFETY:
DO NOT EXCEED 250 DEGREES AS OIL MAY IGNITE.

Step 3: Test low oil pressure switch.

- Test low oil pressure switch by removing wiring harness connector and install a jumper across switch connector pins A and B.
- Connect an ohmmeter across switch connector pins A and D. Ohmmeter should indicate open circuit.
- Connect an ohmmeter across switch connector pins B and C. Ohmmeter should indicate continuity.
- Remove ohmmeter and leave low oil pressure wiring harness disconnected.
- Place the Battle Short Switch in the ON position, the Start-Run-Stop Switch in the Start position and allow the electric fuel pump to fill the day tank.
- Check that ohmmeter indicates open circuit on pins B and C.
- Connect ohmmeter across pins A and D. Ohmmeter shall indicate continuity.
- If switch fails to meet continuity requirements, replace low oil pressure switch.
- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

HINT:
If more than 30 percent of wires are damaged or have been repaired, replace the wiring harness.

Step 4: Test over-speed switch.

To test over-speed switch you should have continuity between connector pins A and B and between G and H. You should have discontinuity between pins A and C, between D and E and between F and J. Replace over-speed switch if continuity or discontinuity checks are not verified.

- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

Step 5: Test day tank fuel level and the low fuel cutoff switch.

- To test the day tank fuel level and the low fuel cutoff switch drain the day tank.
- Disconnect solenoid connector from day tank and float switch connector.
- Using an ohmmeter, ensure there is continuity between switch connector pins A and B and between pins C and D (if not either the float is sticking or the switch is bad).
- Connect fuel solenoid connector and float switch connector.
- Place generator Battle Short Switch in the On position, push in CB1, and place Start-Run-Stop Switch to the Run position.
- When electric fuel transfer pumps have refilled day tank (fuel pumps stop pumping) turn off the Battle Short Switch, place Start-Run-Stop Switch to Stop, and pull out CB1.
- Disconnect fuel solenoid connector and float switch connector.
- Ensure the circuits between pins A and B and pins C and D are open, if not, replace the switch.
- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

Step 6: Test fuel solenoid valve. (Here are two methods to test)

- Disconnect electrical connector on solenoid valve.
- Intermittently apply 24 volts to the terminals on the solenoid valve connector and listen for evidence of solenoid actuation. If no solenoid action is heard, replace the solenoid valve
- Reconnect the electrical connector

- OR

- Drain fuel day tank
- Place generator Battle Short Switch in the On position, push in CB1, and place Start-Run-Stop Switch to Run position.
- If day tank does not refill, ensure the electric fuel transfer pumps, day tank fuel level, low fuel cutoff switch and the interconnecting wire harnesses are operational. If they are operational the fuel solenoid valve is defective and must be replaced.
- Check wiring harness for continuity of individual wires using a multimeter or continuity light.

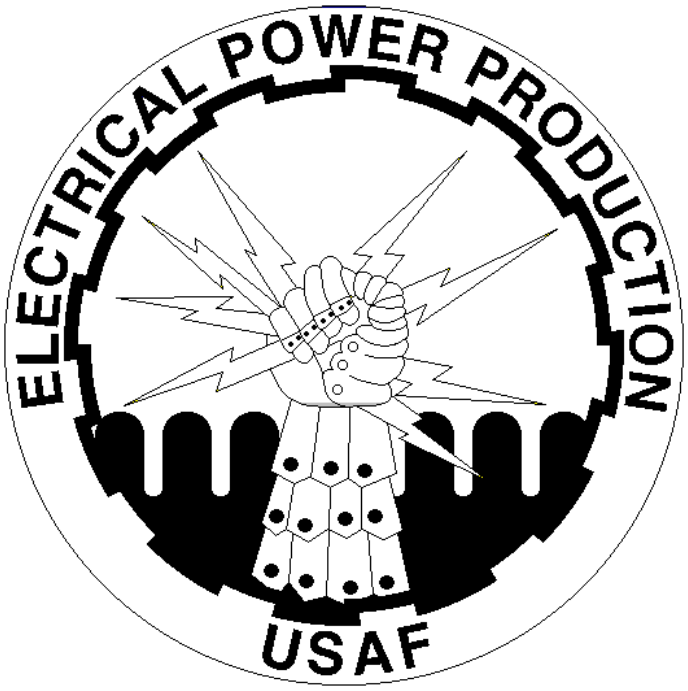
Review Questions
for
Test

Question	Answer
1. What is the resistance reading in ohms for the coolant temperature transmitter with the engine at operating temperature?	a. 15-30 b. 280-340 c. 480-680 d. 680-740
2. What is the over-temperature switch suspended in, during its test procedures?	a. Oil b. Water c. Antifreeze d. Boiling water
3. What is the percentage of damaged or repaired wires before replacing the wiring harness becomes necessary?	a. 10 b. 20 c. 30 d. 40
4. When will you replace the over-speed switch?	a. Continuity and discontinuity checks are not correct b. Engine has shut down for over-speed c. If the magnetic pickup is defective d. During an annual inspection
5. Which meter will you use to test the wiring harnesses?	a. Voltmeter b. Ohmmeter c. Clamp-on ammeter d. All of the above

TEST

Performance Checklist		
Step	**Yes**	**No**
The trainee:		
1. Tested the transmitters		
2. Tested the over-temperature switch		
3. Tested low oil pressure switch		
4. Tested overspeed switch		
5. Tested low fuel cutoff switch		
6. Tested fuel solenoid valve		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



ENGINE PROTECTIVE DEVICES

MODULE 16 **AFQTP UNIT 12**

REPLACE (16.12.5.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

REPLACE

Task Training Guide

STS Reference Number/Title:	16.12.5., Replace Engine Protective Devices
Training References:	• 35C2 series Technical Order
Prerequisites:	• Possess, as a minimum, 3E032 AFSC
Equipment/Tools Required:	• General tool box • Personal safety equipment
Learning Objective:	• Replace engine protective devices.
Samples of Behavior:	• The trainee will replace the over-temperature and oil pressure transmitter. • The trainee will replace the engine protective switches.
Notes:	
• To successfully complete this element follow the steps outlined in the applicable technical manual exactly--no exceptions. • Any safety violation is an automatic failure.	

REPLACE

Background: TO 35C2-3-446-1 technical order for the MEP-005A was used during the development of this AFQTP. Many of the protective indicators located on MEP generators are in the A9 fault indicator panel. These include:

- **Coolant high temperature indicator** - illuminates if engine coolant temperature exceeds 220 degrees.
- **Low oil pressure indicator**- illuminates if engine lube oil pressure falls below 20 psi.
- **Overspeed fault indicator** - illuminates if engine speed exceeds 2400 to 2450 rpms.
- **No fuel indicator** - indicates that there is only enough fuel in day tank for one minute. If either one of these indicators are activated, another set of their contacts initiates engine shutdown.

To Perform the task, follow these steps:

Step 1: Replace coolant temperature transmitter.

The coolant temperature transmitter reads a temperature signal and sends that signal to the meter located on the control panel. The coolant temperature transmitter is located on the engine thermostat housing.

- Drain approximately 1 gallon of coolant from the radiator.
- Unscrew the wiring connector from the temperature transmitter.
- Unscrew the temperature transmitter from the thermostat housing.
- Install the new temperature transmitter into thermostat housing spacer and torque to 12-15 foot-pounds and reconnect the wiring connector.
- Refill radiator

Step 2: Replace oil pressure transmitter.

The oil pressure transmitter reads a pressure signal and sends that signal to the meter to indicate engine oil pressure.

- Remove nut, washer and electrical lead from oil pressure transmitter.
- Unscrew oil pressure transmitter from coupling in engine block.
- Screw in oil pressure transmitter in engine block and torque to 20 foot-pounds.
- Install electrical leads and secure with washer and nut.

Step 3: Replace over-temperature switch.

The over-temperature switch senses engine temperature and transmits an engine shutdown and fault signal when engine temperature is above 220 degrees.

- Unscrew wiring connector from the over-temperature switch connector.
- Unscrew over-temperature switch from cylinder head assembly.
- Install new over-temp switch in cylinder head assembly and torque to 12-15 ft-lbs.

Step 4: Replace low oil pressure switch.

Low oil pressure switch will shut down the engine if oil pressure is below 20 psi.

- Disconnect electrical connectors from the low oil pressure switch.
- Unscrew switch from block adapter.
- Install new low oil pressure switch into block adapter and torque to 20 ft-lbs.

Step 5: Replace overspeed switch.

To replace the overspeed switch remove the wiring harness connector from speed switch connector and use a 1-1/8 inch wrench to remove or install the overspeed switch. There is no torque value for the overspeed switch so use good mechanical sense when tightening this critical and expensive device.

Step 6: Replace day tank fuel level and the low fuel cutoff switch.

The day tank fuel level is used to fill the day tank. It sends a signal to the fuel pumps to turn on when the day tank is low and shut off the fuel pumps when the day tank is filled. The low fuel cutoff switch controls the fuel solenoid valve that will shut down the generator when it has one minute of fuel remaining. To remove the day tank fuel level and the low fuel cutoff switch, disconnect the electrical connector and unscrew the fuel level and cutoff switch from day tank. There is no torque value for these devices; do not over tighten!

Step 7: Replace fuel solenoid valve.

The fuel solenoid valve is the device that cuts off the fuel supply to shutdown the engine. To replace the fuel solenoid valve:

- Disconnect the fuel supply hose, electrical connector and fuel return line.
- Unscrew tee from day tank assembly.
- Remove elbows and tee from fuel solenoid valve.
- Install in reverse order

Step 8: Replace wiring harness assembly.

The wiring harness is used on the transmitters, switches, and the rectifier assembly, and is what physically sends that signal to where it needs to go. Prior to removal, tag or otherwise identify electrical terminals, connectors and wiring and location of support clamps to facilitate installation. Remove wiring harness terminal wires and connectors as required for access to other components and to replace damaged parts. Installation is in the reverse order of removal.

Review Questions
for
Replace

Question	Answer
1. How many minute(s) of operation will the day tank have if the low fuel light is illuminated?	a. 1 b. 2 c. 3 d. 4
2. With what do you test the coolant temperature transmitter?	a. Voltmeter b. Temperature probe c. Ohmmeter d. Ammeter
3. Where is the over-temperature switch installed?	a. Engine thermostat housing b. Cylinder head assembly c. Engine block d. Radiator
4. What is the torque value in foot-pounds for the overspeed switch?	a. 10 b. 20 c. 50 d. There is no torque value
5. Which safety device shuts off fuel to the engine?	a. Low fuel cutoff switch b. Fuel solenoid valve c. Day tank fuel level d. Selector valve
6. What physically transmits the signal to and from engine and generator devices?	a. Wiring harness b. Transmitter c. Rectifier d. Switch

REPLACE

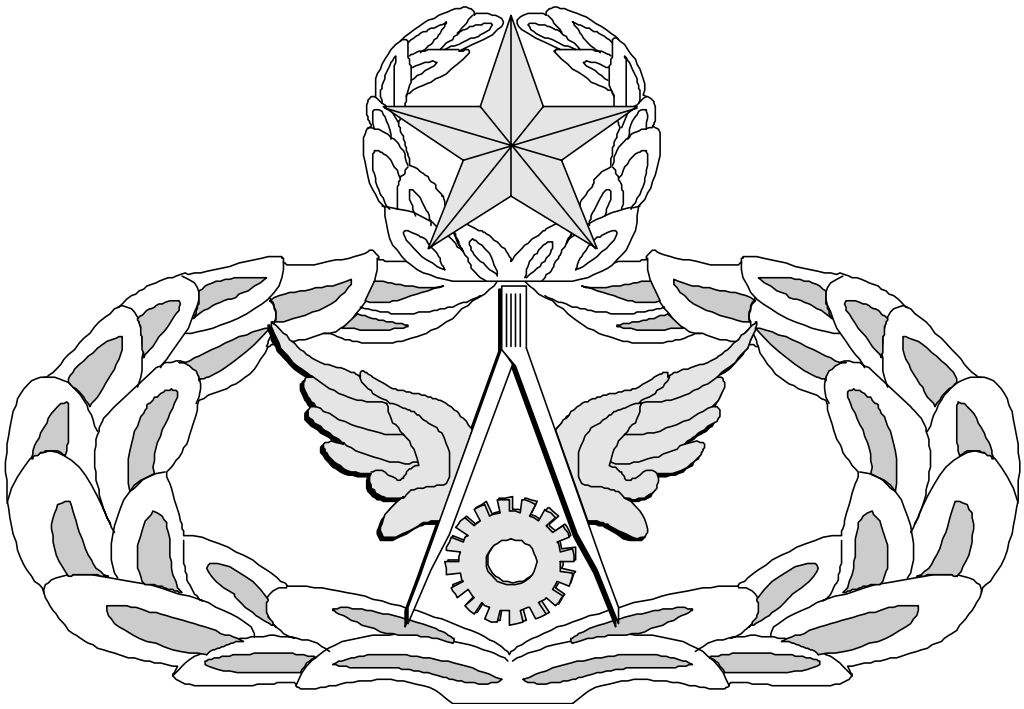
Performance Checklist		
Step	**Yes**	**No**
Did trainee:		
1. Replace coolant temperature transmitter?		
2. Replace oil pressure transmitter		
3. Replace over-temperature switch		
4. Replace low oil pressure switch		
5. Replace overspeed switch		
6. Replace day tank fuel level and the low fuel cutoff switch		
7. Replace fuel solenoid valve		
8. Replace wiring harness assembly		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



For

ELECTRICAL POWER PRODUCTION

(3E0X2)

MODULE 16

GASOLINE AND DIESEL ENGINE MAINTENANCE

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

TUNE-UP GASOLINE ENGINE SYSTEMS

(3E0X2-16.11.)

Question	Answer
1. The carburetor provides the proper gasoline to air mixture for the combustion chamber for all loads and speeds.	a. True
2. What determines if a carburetor is balanced?	b. Proper air and fuel mixture
3. The air is divided and directed by ducts and baffle plates to insure what type of cooling?	b. Uniform cooling of all parts
4. Why should an air cooled engine never operate with any part of the shrouding removed?	c. Retard the air cooling capabilities of the engine
5. How can you verify that the number 1 cylinder is on the compression stroke?	d. All of the above
6. What is the minimum rpm that the engine must operate when checking the timing with a neon light?	d. 2000
7. Under what conditions should the oil bath air cleaner be serviced daily?	d. Dusty
8. The gasoline strainer prevents sediment, dirt, and water from entering the carburetor and causing engine problems.	a. True

INSPECT

(3E0X2-16.12.1.)

Question	Answer
1. What psi must not be exceeded when using compressed air to clean protective devices?	c. 30
2. Where are the coolant temperature and the oil pressure transmitters located?	d. Engine thermostat housing and the engine block
3. At what psi will the generator shut down for low oil pressure?	b. 20
4. What are the four protective switches covered in this QTP?	a. Over temperature, over-speed, low oil pressure, low fuel cutoff

TEST

(3E0X2-16.12.2.)

Question	Answer
1. What is the resistance reading in ohms for the coolant temperature transmitter with the engine at operating temperature?	d. 680-740
2. What is the over-temperature switch suspended in during its test procedures?	a. Oil
3. What is the percentage of damaged or repaired wires before replacing the wiring harness becomes necessary?	c. 30
4. When will you replace the over-speed switch?	a. Continuity and discontinuity checks are not correct
5. Which meter will you use to test the wiring harnesses?	b. Ohmmeter

REPLACE

(3E0X2-16.12.5.)

Question	Answer
1. How many minute(s) of operation will the day tank have if the generator shuts down for no fuel?	a. 1
2. With what do you test the coolant temperature transmitter?	c.Ohmmeter
3. Where is the over-temperature switch installed?	b. Cylinder head assembly
4. What is the torque value in foot-pounds for the over-speed switch?	b. There is no torque value
5. Which safety device shuts off fuel to the engine?	b. Fuel solenoid valve
6. What physically transmits the signal to and from engine and generator devices?	a. Wiring harness